

Applying Distributed Energy Resources in Mission-Critical Applications for Federal Facilities

James Tuller

Director, Project Development
Sure Power Corporation

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Why is Energy Security an Issue?



Power disturbances cause economic damage¹

- Increasing business digitalization depends upon electrons
- Insurance industry recognizes data as property²

Centralized grid architecture vulnerable

- Unsecured transmission lines
- A localized failure can cause widespread outages

New lessons learned from 9/11

- Backup power systems do fail to perform³
- Diesel fires led to collapse of 7 World Trade Center⁴

¹ "The Cost of Power Disturbances to Industrial and Digital Economy Companies," EPRI CEIDS, June 29, 2001.

² John Leming, "Ingram Micro Court Decision Sets New Precedent," *Risk Management*, August 2000, pp. 12-16.

³ John Diamond, "Planning for Failure," *Energy Decisions*, March 2002, pp. 7-9.

⁴ Associated Press, "Diesel Fire Led to WTC Collapse," March 2, 2002.

DG Seems Like a Natural Solution...



Distributed Assets

- Allow physical control and security
- Less risk with multiple assets and multiple routes

Combined Heat & Power (CHP)

- Increases energy efficiency / lower energy usage
- Reduces greenhouse gas emissions

Environmental Friendly Generation

- Natural gas engines / turbines w/ SCRs, fuel cells, etc.
- Reduces NO_X, SO_X and other pollutants

...but There Are Still Obstacles



Grid Interconnection

- AC synchronization to the grid is an issue for utilities
- Network-style grids also have one-way flow issues

Economics

- Gas vs. Electric "spark spread" operating cost comparisons
- Prime mover capital costs and standby backup charges

Reliability

- The grid is the most reliable source of generation
- The best DG units are still only 96% available

Adaptability

- Modularity and scaleability
- Not core competency of facility managers

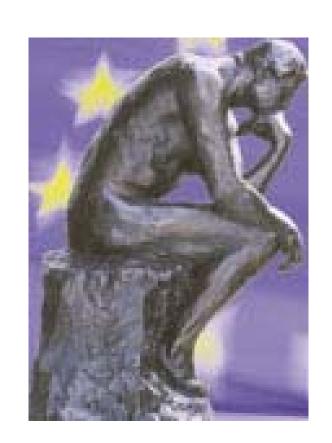
So Where Does DG Make Sense?



Sure Power's Thesis

DG makes sense where:

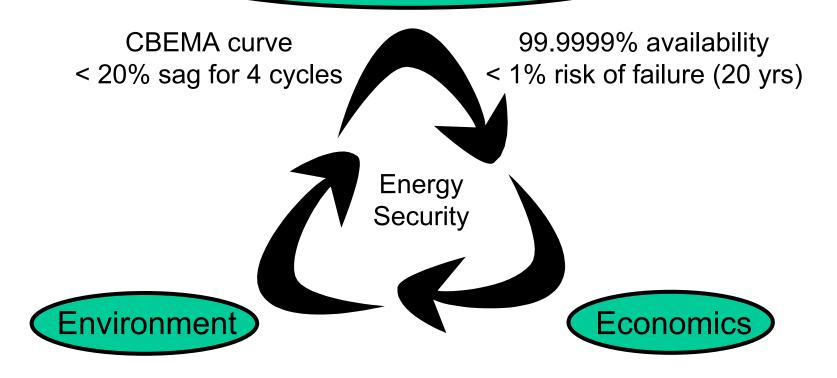
- Serious consequences (financial or otherwise) occur when a critical system experiences a one-second power deviation; and
- 2) The cost of a traditional grid + backup system, normally purchased to protect the critical system, would pay for a high availability DG system



Critical Facility Requirements



Power Quality and Availability



Low Emissions (NO_X, CO₂) Energy Efficiency

- ↓ Capital expense
- ↓ Operating expense

Client Benefits of Sure Power



- Economic Savings
 - Lower energy costs due to waste heat utilization
- Low risk of failure
 - Reduced from 67% to just 1% in 20 years
 - No dependence upon vulnerable transmission lines
- Environmental Leadership
 - Reduced emissions and associated costs
- Space Savings
 - Boilers, backup systems are eliminated
 - Containerized system needs no conditioned space
- Modularity matches expense to load
 - Start small, grow large in desired increments

Utility Benefits of Sure Power



- Eliminate one of biggest barriers to DG
 - Utility friendly > grid sees system as a load
 - No AC paralleling, no two-way power flow
- Reduce risk of stranded T&D assets
 - Containerized, point-of-use solution
 - Maintains high residual value with labor & wire
 - Can be relocated if demand shifts

Federal Facility Applications



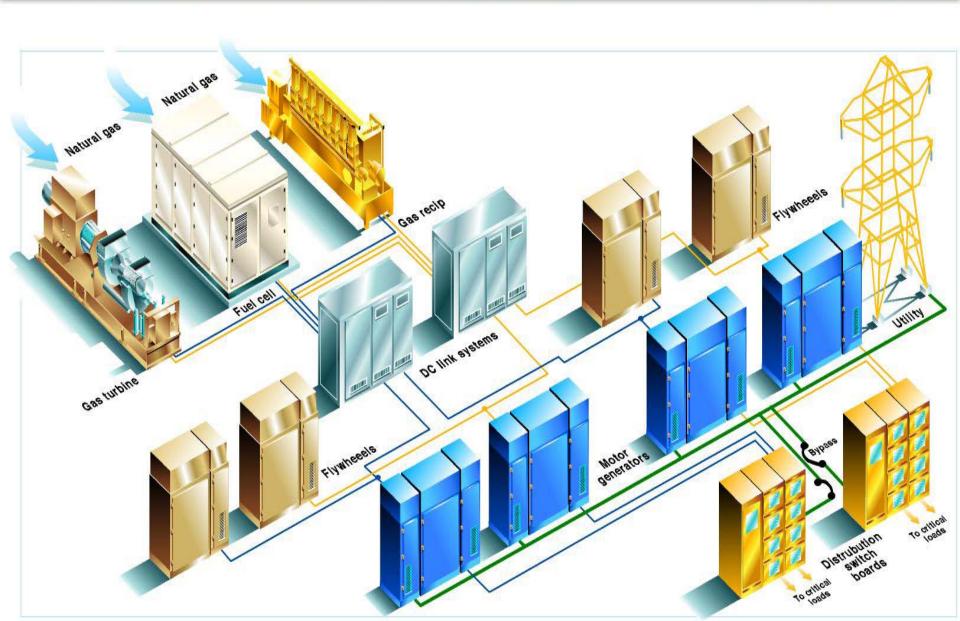
- Facilities w/ Data Communications Hubs
 - Data centers
 - Telecommunications nodes
 - Disaster recovery sites
- Energy Intensive Facilities
 - Research laboratories
 - Military installations
 - Others w/ sophisticated instrumentation



SUPPORTING SLIDES The Sure Power System And Economic Analysis

SurePower System





Total On-Site Utility Plant



Packaged System

- Factory built and tested system improves product quality
- Reduces on-site installation time to just a few weeks
- "System-in-a-box" has high residual value due to labor and wiring normally lost in "as-built" systems
- Reduces owner risk by having moveable asset
- Reduces square footage required for mechanical and electrical plant



Case Study







The reliability of the 'six 9s' computer grade electricity that Sure Power delivers isn't a luxury for us at First National Bank of Omaha, it's a critical difference over existing power arrangements that will substantially increase our computer uptime. The result is a tremendous leap in our competitive advantage. With Sure Power, First National can raise our customer's service expectations while generating higher revenues.

Dennis C. Hughes
Director of Property Management
First National Buildings, Inc.
(402) 633-3926

DOE Sponsored Project



Applying DER to existing internet data center declared "national asset" by the White House

- Exodus, A Cable & Wireless Service (data center host)
- Sure Power (power system provider)
- EPRI (benchmark and analysis)
- D&R Intl. & SVMG (dissemination), Battelle (software)

\$2.2M cost share project managed by ORNL

- Benchmark existing facility parameters
- Configure and install Sure Power System
- Compare new facility attributes and share results
 - Availability
- Energy Efficiency

Power Quality

- Emissions
- Utility Integration

Economics

Traditional System Comparison



Elements included in comparison:

- Utility fees for redundant feeds
- Utility fees for exceeding w/sq. ft. limits
- Switchgear
- UPS
- Batteries
- Emergency standby generators
- Paralleling gear
- Air conditioning system
- Installation labor and materials
- Overhaul and replacement
- Operations and maintenance
- Electricity purchases

Assumptions

- 60,000 sq. ft. raised floor
- \$0.075 / kWh electric service

• \$4.50/MMBtu gas

• 12,500 admin space

- 2.0 kW per rack3600 racks
- 8% return

Traditional System

Utility + Backup + HVAC Estimated 99.99% availability

- Power
 - (12) 2.5MVA 13.8K/480 Utility xfmr (2N)
 - 1st feed charged above 20W/sq. ft.
 - (24) 600kVA UPS (includes N+1)
 - (16) 2250kVA diesel generator (N+1)
- Cooling
 - (12) 350 ton centrifugal chillers
 - (24) 900 gpm Chilled Water Pumps
 - (12) 1,050 gpm Condenser Water Pumps
- Building Space 45,000 sq. ft. required for Mech/Elect

Sure Power System

Primary Power + CHP Certified 99.9999% availability

Power

Sure Power System w/ gas recips

- (8) 1.58MW engines
- Factory built system

Single utility service (backup)

- (3) power paths to loads (N+1)
- Cooling

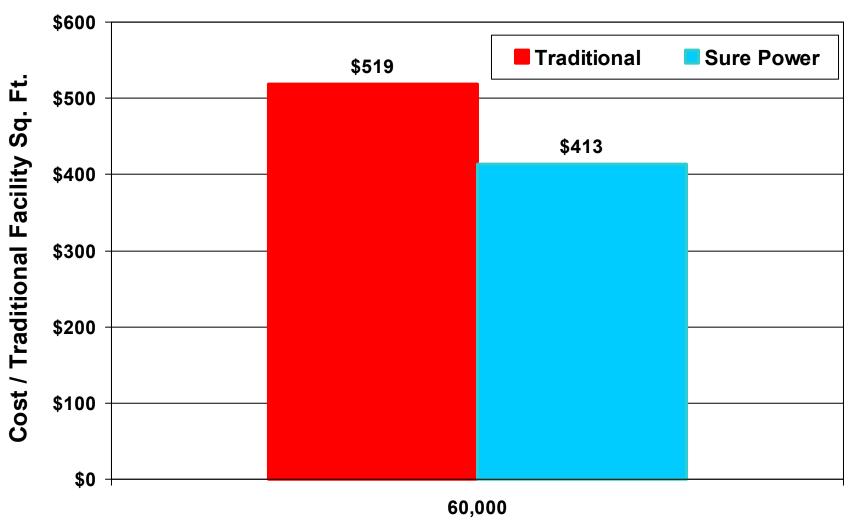
Hybrid central chiller plant (0.29 kW / ton)

- (2) energy sources
- **Building Space**

3,500 sq. ft. required for Mech/Elect

CAPEX – Turnkey Installation

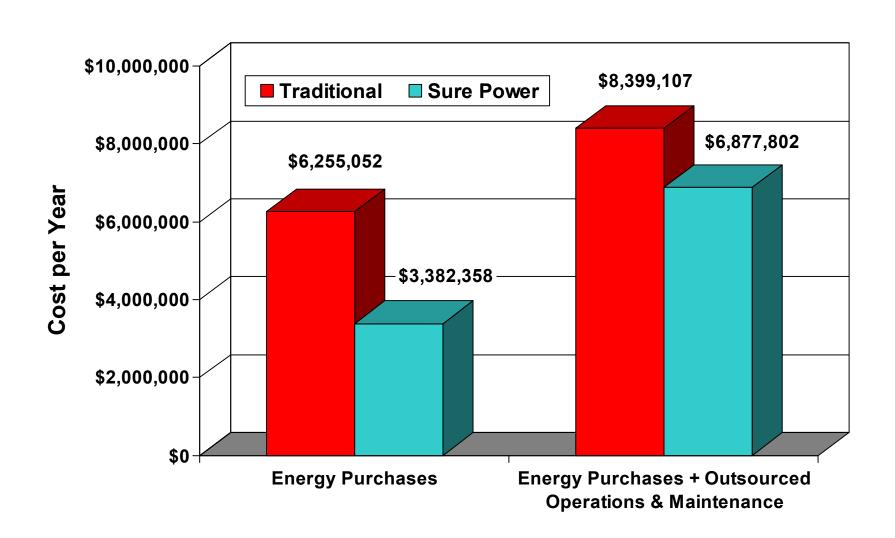




Data Center Raised Floor Sq. Ft.

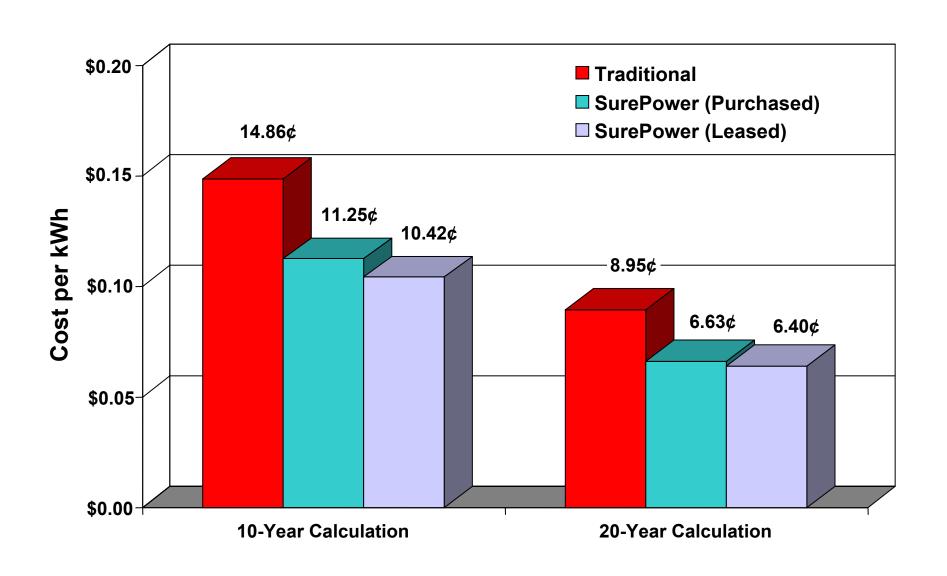
OPEX Comparisons





NPV Cost Comparison





Value of Space Savings



Traditional New Construction

60,000 sq. ft. Raised floor

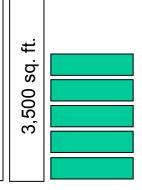
12,500 sq. ft. Admin

45,000 sq. ft. Mechanical Electrical Total Building 117,500 Sq. ft.

New Construction w/ Sure Power

60,000 sq. ft. Raised floor

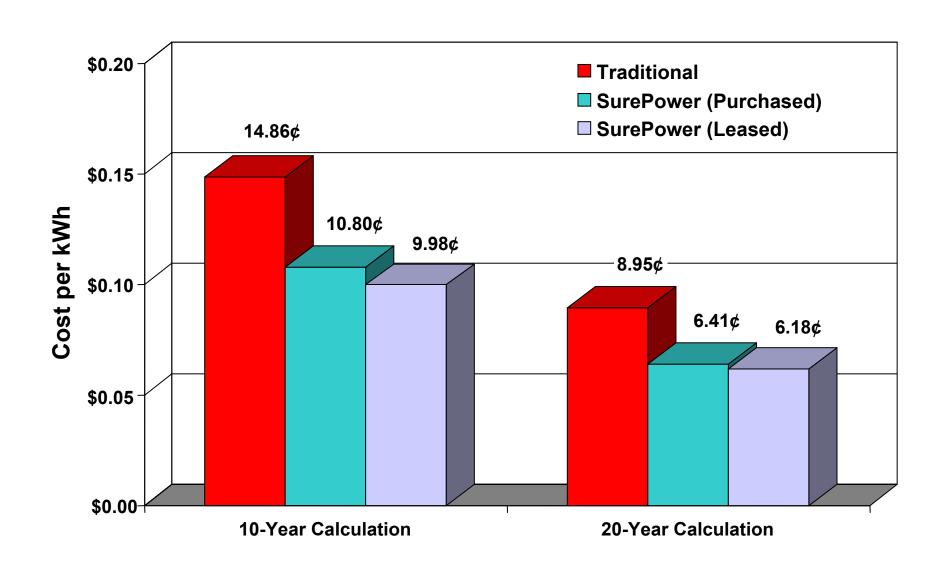




Total Building 76,000 Sq. ft.

NPV w/ Building Cost @ \$100/Sq. Ft.





Value of Modularity



